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(54) On line interlacing of bulked continuous filament yarns and low-melting binder fibers.

(57) This invention relates to a process for combining a low melting binder fiber with a continuous filament base yarn to form a composite yarn having good bulk and a high level of interlace. More particularly, the process involves bulking a continuous filament yarn, combining it with the low-melting binder fiber, interlacing the combined yarn, and then fixing the interlace.

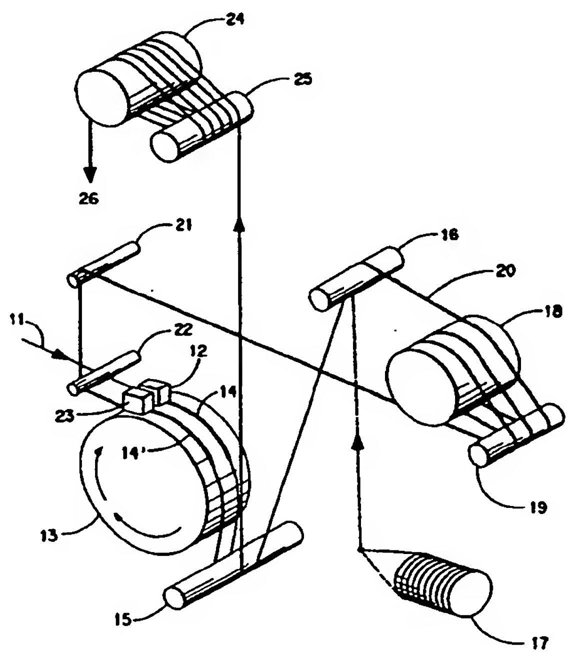

FIG.1

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BRIEF DESCRIPTION OF THE FIGURES

FIG. 1 is a schematic of a preferred process of this invention.

FIG. 2 is a schematic of a process in which the continuous filament base fiber and the low-melting binder filaments are co-bulked and interlaced as in a conventional process.

FIG. 3 is a schematic of a process in which the continuous filament base fiber and the low-melting binder filaments are interlaced without fixing the interlace.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The bulking step of this process involves crimping or otherwise adding texture to the filaments of the continuous yarn bundle in order to form a bulked yarn having little or no interlace. Bulking processes of this general type are disclosed in Breen and Lauterbach, U.S. Patent No. 3,854,177, whose disclosure is incorporated herein by reference. Interlace is to be minimized in order to more effectively combine and then, at a later stage, interlace together the filaments of the continuous base yarn with those of the low-melting binder fiber. The bulking step is most effectively performed immediately following drawing of the freshly-spun continuous filament yarn. When a hot-draw process is used, the yarn will be heated during drawing, and the elevated temperature will assist in imparting adequate bulk to the fiber. It has been found that an effective amount of bulk can be added to the yarn with little or no interlace by impinging the yarn with a fluid stream within a single-impingement bulking jet. A particularly useful jet of this type is the dual-impingement jet described in Coon, U.S. Patent No. 3,525,134, the disclosure of which is herein incorporated by reference, where one of the fluid orifices has been plugged, rendering it inoperative. When such a jet is used, the bulk developed in the jet should be set as further described below.

The bulked continuous filament base yarn is then combined with the low-melting binder fiber using conventional methods, and the composite yarn is then interlaced. As used herein the term interlacing refers to extensive entanglement or comingling of the filaments which make up the yarn bundle. Accordingly, the interlacing step of this invention should effectively comingle the filaments of the bulked base yarn with those of the low-melting binder fiber. This can be accomplished using conventional interlacing methods, such as impinging the yarn with multiple fluid streams in a multiple-impingement jet. The dual-impingement jets described in Coon (without the plugging modification described for the bulking step above) are particularly useful.

It is important that the interlace in the composite yarn be fixed. The term "fixing" as used herein refers to the process of reducing the tension on the freshly interlaced composite yarn to a virtually tension-less state or otherwise establishing the degree of interlace in the composite yarn so that it is not later pulled out when the yarn is placed under normal tension. One method for fixing the interlace is to forward the interlaced composite yarn onto a movable surface such as a rotating drum where the yarn is allowed to rest in a substantially tension-free state in the form of a bulky "caterpillar", thereby fixing the interlace and setting the bulk. If interlaced at elevated temperatures, the yarn can also be cooled during this step. The surface of the drum may consist of a perforated plate or mesh screen, and a partial vacuum can be applied through the plate or screen to hold the yarn to the surface and provide for rapid cooling.

Referring to FIG. 1 continuous filament base yarn 11 is spun, drawn, and heated using methods well known in the art and forwarded while still in a heated condition into a single-impingement bulking jet 12 where it is treated with a single hot fluid stream having sufficient temperature and pressure so as to crimp the yarn without significant interlacing. The crimped yarn exits the jet 12 and impinges upon a drum 13 which is rotating in the direction shown by the arrow. The drum has a perforated surface (not shown) such as a screen on which the yarn cools to set the crimp. The jet to screen clearance is in the range of 0.045 ± 0.01 in. (0.11 ± 0.025 cm). A partial vacuum may also be applied to the yarn to hold it to the perforated surface and help cool the yarn. While on the drum the yarn is in the form of a bulky caterpillar designated by the bold line 14. Preferably, a water mist quench (not shown) is applied to the caterpillar while it is on the drum to further help cool the yarn. From the drum, the threadline passes under stationary guide pin 15 and over another stationary guide pin 16, where the low-melting binder yarn 17 is added to the threadline.

The combined yarn 20 then passes around a motor driven auxiliary roll 18 and associated separator roll 19 in several wraps which provides the same speed and tension for both the base yarn and the low-melting binder filaments prior to interlacing so that the resulting interlaced yarn is smooth in appearance without any puckering. The speed of the auxiliary roll 18 is adjusted to maintain the caterpillar 14 at the desired length to adequately set the bulk.

The combined yarn 20 passes over a pair of guide pins 21 and 22 which can be stationary pins or more preferably, rotating pins, and is forwarded

This example describes a process, shown schematically in Fig. 2, in which the base yarn 31 and the binder filaments 33 are co-bulked and intermingled in a single step in a dual-impingement jet 32 to demonstrate the disadvantages of such an approach versus the current invention. The process conditions were identical to those used above except that the single-impingement jet was eliminated. The random copolymer binder yarn 33 was run over and wrapped around the auxiliary roll 34 and its associated separator roll 35 to ensure constant speed, then combined with the base nylon 6,6 continuous filament yarn 31 as it exited the hot chest, but before entering the dual-impingement jet 32. The combined yarn was bulked and intermingled in the dual-impingement jet by hot air at 225 °C. Exiting the jet in the form of caterpillar 38, the yarn was cooled and the crimp set while on rotating screened drum 39 before passing over pin 40 to take-up rolls 41 and 42 which led to wind-up 43 (not shown). Due to the low melting point (201 °C in air), the binder filaments became tacky and broke during bulking. The broken ends were visible on the package and in photographs taken of the yarn after bulking. The bulked yarn had an APDC value of 2.2 cm, which would normally be indicative of a high level of interlace; however in this instance examination of the yarn indicated that the low APDC value was not related to a high interlace level, but rather was due to fusion of the filaments by the melted binder filaments.

COMPARATIVE EXAMPLES B

This example demonstrates the need for using the rotating screened drum (or similar equipment to provide a tension-free state) following the dual-impingement jet in order to achieve acceptable interlace. The process is shown schematically in Fig. 3. Process conditions were identical to those used in Example 1 with continuous filament nylon 6,6 yarn 51 passing from the hot chest to single impingement jet 52, exiting to form a caterpillar 54 which was cooled on rotating screen drum 53, after which it passed around guide pin 55 to guide pin 56 where it was combined with low melting copolymer binder yarn 57, the speed and tension of which were controlled using auxiliary roll 58 and associated separator roll 59. In this example, however, the dual-impingement jet 60 was located outside of the bulking chest and had no screened drum associated with it so that the yarn formed a rooster tail 61 upon exiting jet 60 and before going to the take-up rolls 62 and 63 and on to wind-up 64. While the binder yarn exhibited no breaks and was continuous throughout the resulting BCF bundle, it was not well interlaced with the base yarn and formed loops which were easily separated from the base yarn filaments. The low degree of interlace is reflected in the APDC value of 13.2 cm.

Claims

1. A process for producing a bulked, interlaced composite yarn comprising the steps of:
   a) bulking a continuous filament yarn;
   b) combining a low-melting binder yarn with the bulked yarn to form a composite yarn;
   c) interlacing the composite yarn at a temperature below the melting point of the binder yarn; and
   d) fixing the interlace of the composite yarn.

2. The process of claim 1 wherein the continuous filament yarn is made using a polymer selected from the group consisting of nylon 6,6, nylon 6, polyethylene terephthalate, and polypropylene.

3. The process of claim 2 wherein the low melting binder fiber is made using a random copolymer of the polymer from which the continuous fiber is made.

4. The process of claim 3 wherein the continuous filament yarn is made using nylon 6,6 and the low-melting binder fiber is a random copolymer of nylon 6 and nylon 6,6.

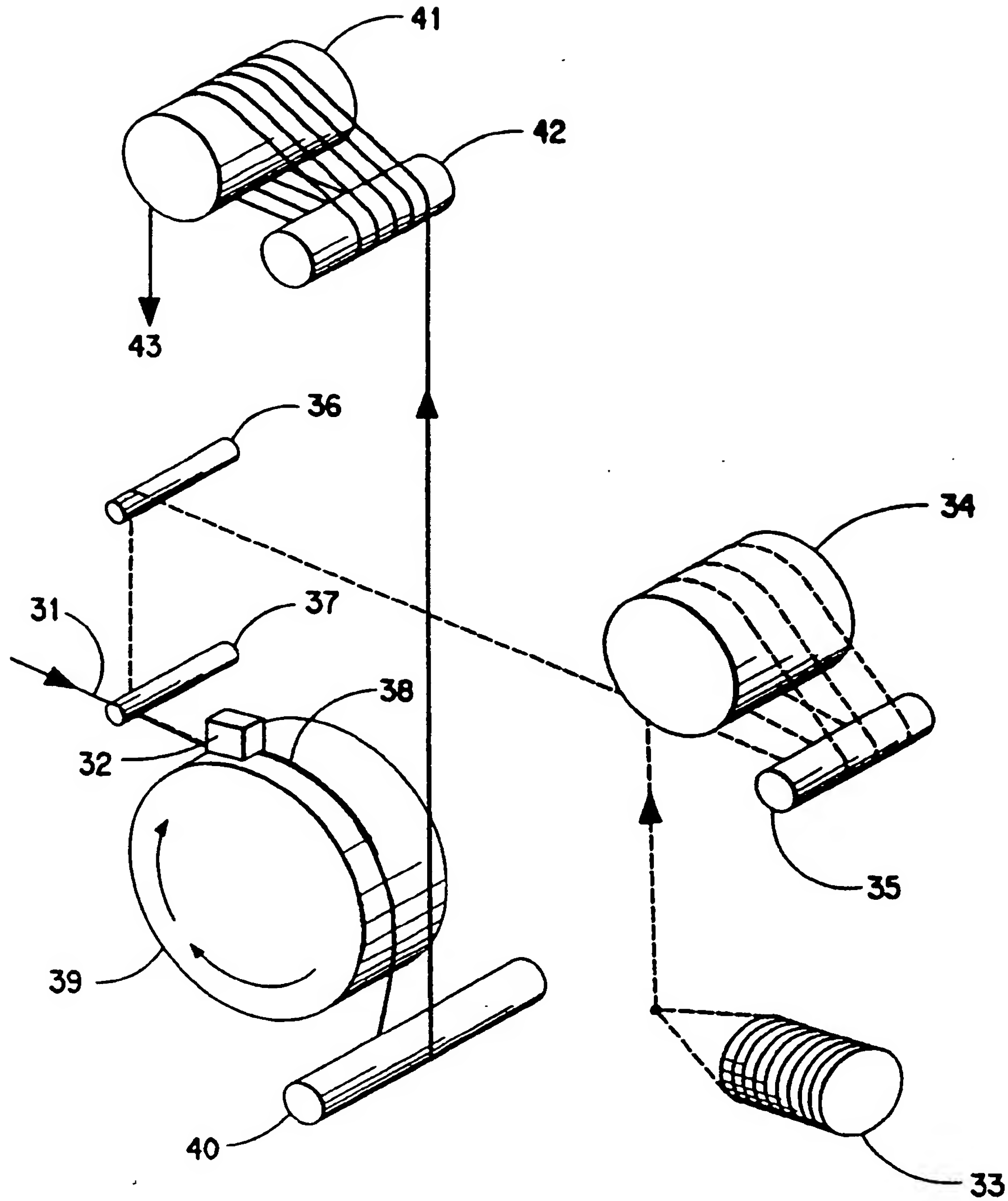

FIG.2

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(54) On line interlacing of bulked continuous filament yarns and low-melting binder fibers.

(57) This invention relates to a process for combining a low melting binder fiber (17) with a continuous filament base yarn (11) to form a composite yarn (20) having good bulk and a high level of interlace. More particularly, the process involves bulking a continuous filament yarn (11), combining it with the low-melting binder fiber (17), interlacing the combined yarn, and then fixing the interlace.

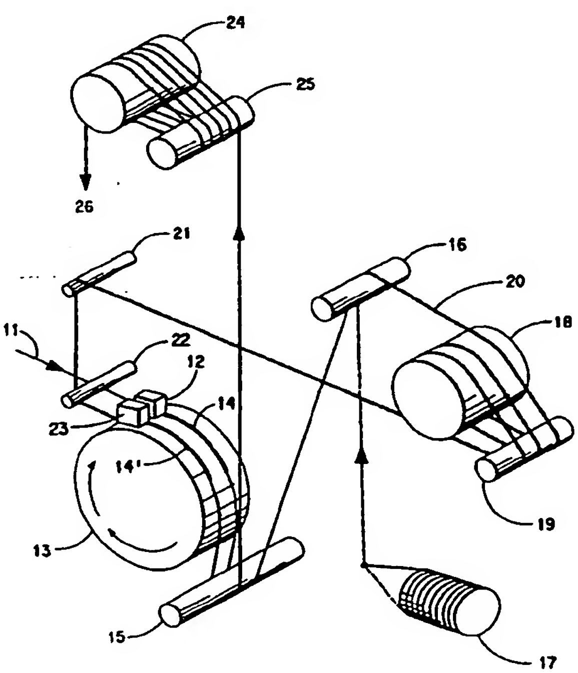

FIG.1

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